



# *University of* **HUDDERSFIELD**

## **University of Huddersfield Repository**

Unver, Ertu, Burke, Patrick and Sorbie, Chris

Rise & Design - The Power of Collaboration: Paxman Scalp Cooling Research

### **Original Citation**

Unver, Ertu, Burke, Patrick and Sorbie, Chris (2017) Rise & Design - The Power of Collaboration: Paxman Scalp Cooling Research. In: Rise & Design - The Power of Collaboration, 20 /Jan/2017, 3M Buckley Innovation Centre Huddersfield, UK. (Unpublished)

This version is available at <http://eprints.hud.ac.uk/31062/>

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: [E.mailbox@hud.ac.uk](mailto:E.mailbox@hud.ac.uk).

<http://eprints.hud.ac.uk/>

# **Rise & Design - The Power of Collaboration: Paxman Scalp Cooling Research**

## **Presentation at Design Network North Symposium**

3M Buckley Centre, Huddersfield, 20 Jan 2017

Dr Ertu Unver	: Principal Enterprise Fellow, (PhD, MSc, PGCert, BSc(Hons) FHEA, fIED) University of Huddersfield, Art Design & Architecture
Chris Sorbie	: KTP Associate,
Patrick Burke	: Technical Manager, Paxman Coolers Ltd, Huddersfield

### Copyrighted Materials:

Unless stated otherwise, this Key Note speak document contains some copyrighted material (for example logos and other proprietary information, including, without limitation, text, software, photos, video, graphics, music and sound ("Copyrighted Material")). The User may not copy, modify, alter, publish, transmit, distribute, display, participate in the transfer or sale, create derivative works, or in any way exploit any of the Copyrighted Material, in whole or in part, without written permission from the copyright owner. Users will be solely liable for any damage resulting from any infringement of copyrights, proprietary rights, or any other harm resulting from such a submission.

- Introduction to scalp Cooling
- Science of Scalp Cooling
- Benefits of Scalp Cooling
- Head Data Analysis
- Application of Rapid Tooling
- Iterations One and Two
- Iterations Three and Four
- Benefits of Rapid Tooling
- Limitations of Rapid Tooling
- Generation 2 Cap
- Benefits of Collaboration





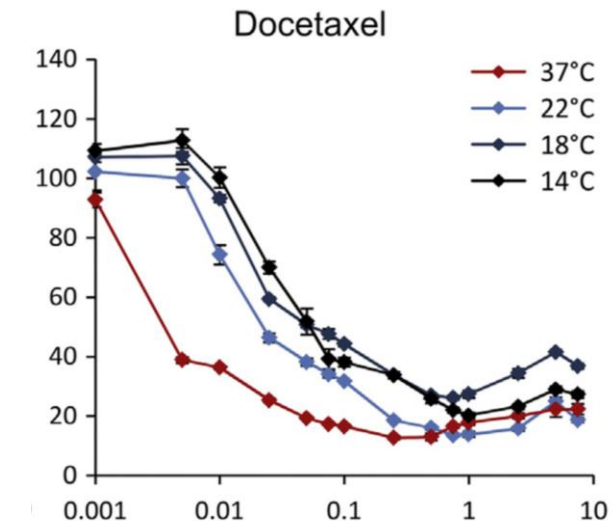
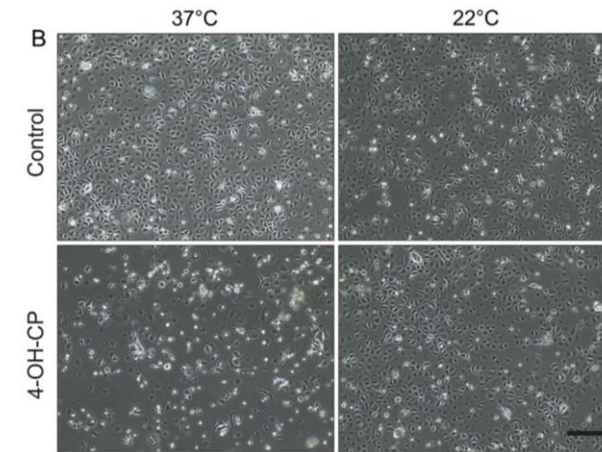
Scalp Cooling is a method used to reduce chemotherapy induced hair loss in cancer patients

Scalp Cooling can result in a high level of retention or complete hair preservation which improves the patients self-confidence and positivity to their treatment and recovery.

Scalp cooling (the cold cap) can be used with all solid tumour cancers that are treated with chemotherapy drugs such as taxanes, alkylating agents and anthracyclines/DNA intercalating agents. These drugs target rapidly dividing cells and the matrix keratinocytes, which results in hair loss.

Scalp cooling works by inducing vasoconstriction of the blood vessels leading to the scalp, this reduces the blood flow to the hair follicles in the period of peak plasma concentration of the relevant chemotherapy agents.

The University of Huddersfield's Biology department along with Paxman's previous Knowledge transfer partnership (KTP) associate discovered that scalp temperature plays an important role in cytotoxic protection.





The benefits of scalp cooling include:

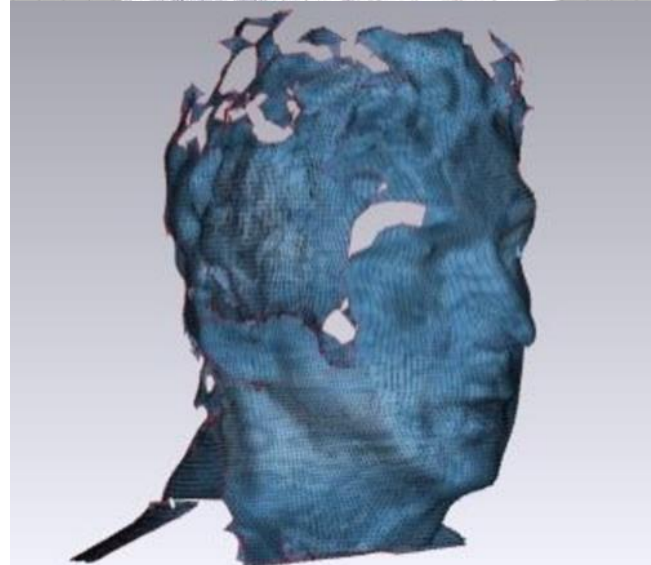
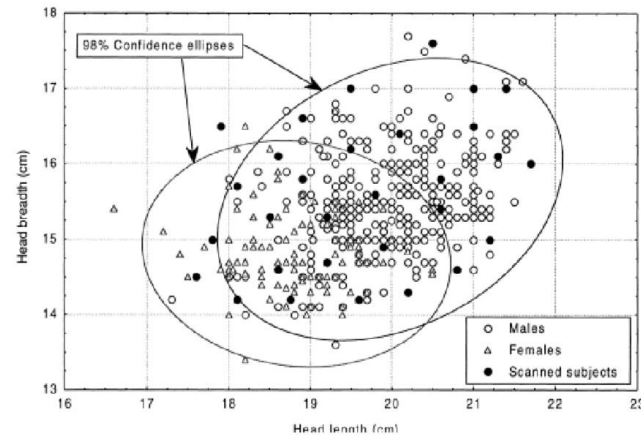
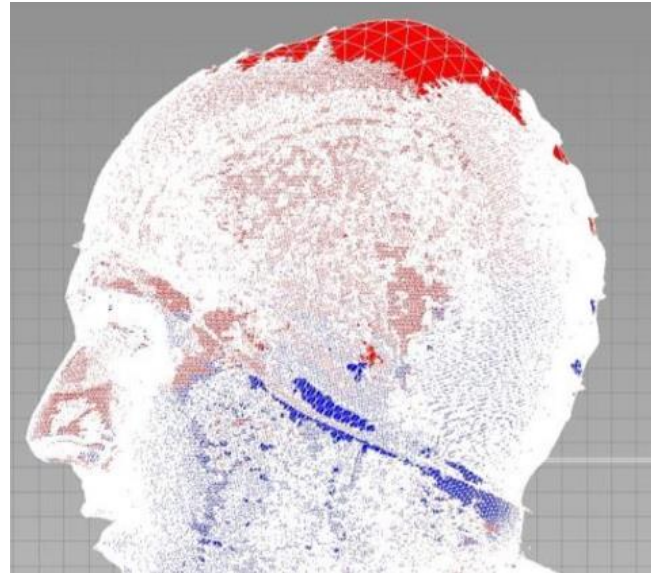
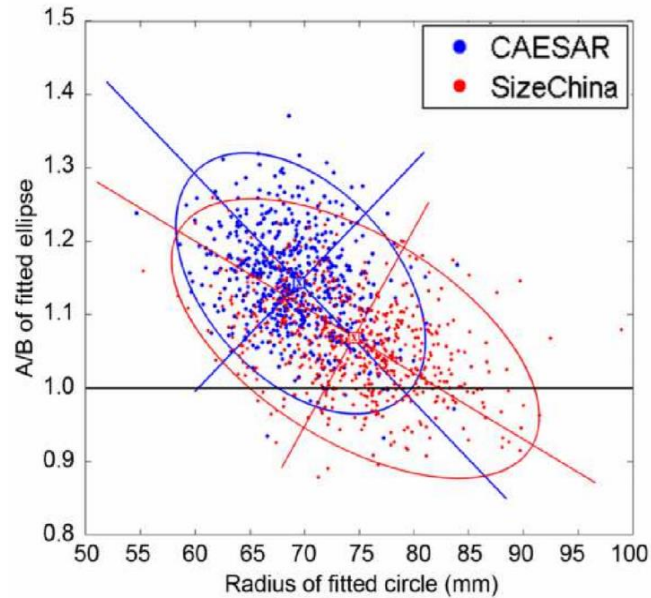
- Greatly reduced risk of hair loss,
- Preserves self image,
- Allows continued social activities,
- Maintains scalp at a constant temperature,
- Comfortable and pain free,
- High level of patient/clinical tolerance and acceptability.

“Nobody knew I was having chemotherapy unless I chose to tell them.” - *Becky*

“8% of patients choose not to have chemo because of fear of hair loss.”

# Design and Development of Paxman's Generation 2 Cap





Using available literature and database collected including data bases such as SizeChina and the CAESAR project, the team were able to identify the average head size needed for scanning.

Before designing the tooling concepts the 3D scan was converted into NURB data to give a more accurate head shape to use for the design process.

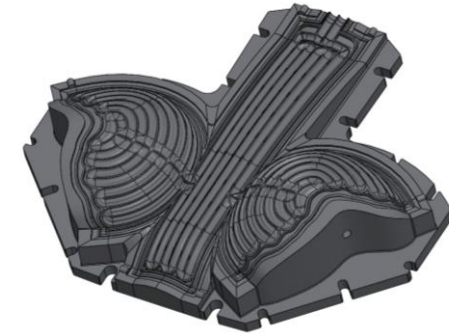
Several concepts were designed including a 3D printed cap, however the technology to print a cap in one go was not readily available



Complex channels, grooves and curves were specifically designed for the manufacturing technique silicone sheet forming.

Both Polyamide (Nylon) and Alumide (Aluminium infused nylon) were printed to test the capabilities of the tooling during production.

3D printing allowed the design and development of a complex tool for a much lower cost than traditional tooling, it also decreased the time of receiving the tool dramatically.



## Iteration One

This used a polyamide tool.

Cost – £2500

This was used to create a prototype, check the fit, size, flow rates and pressure

Problem – Low flow rates, pressure sensitive

## Iteration Two

This used an alumide tool.

Cost - £2000

Issues identified during manufacture, hot silicone was flowing into the channels creating flow rate issues



## Iteration Three

This used an alumide tool.

Cost - £1200

Requested design changes to increase manufacturability,

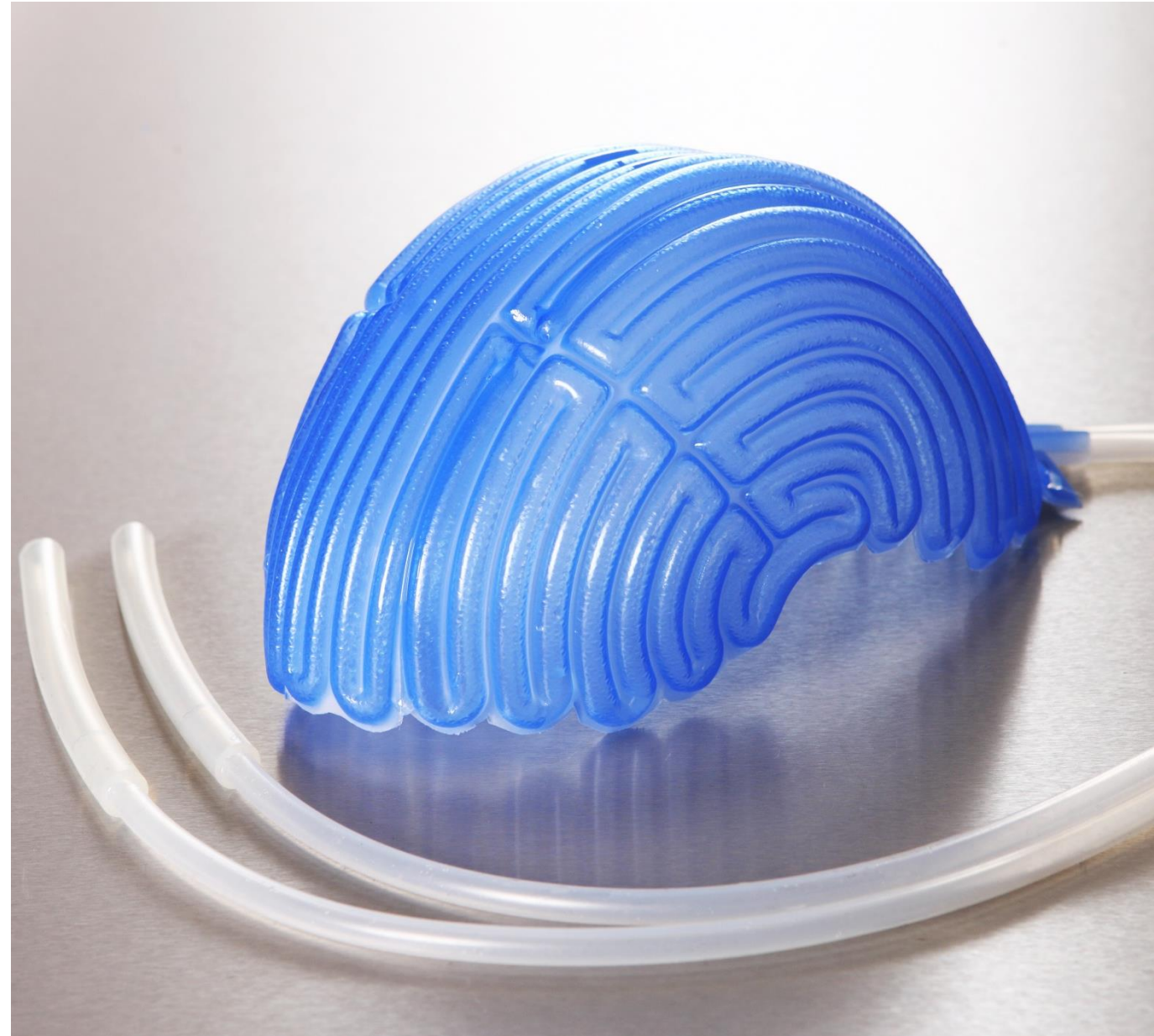
Currently being tested in japan

## Iteration Four

This used an alumide tool.

Cost - £1000

Some manufacturing issues have been identified, so changes have been made for more manufacturing





# Benefits of Rapid Tooling

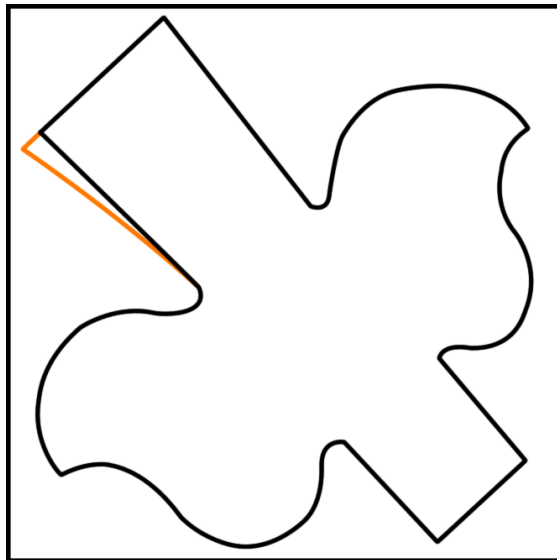
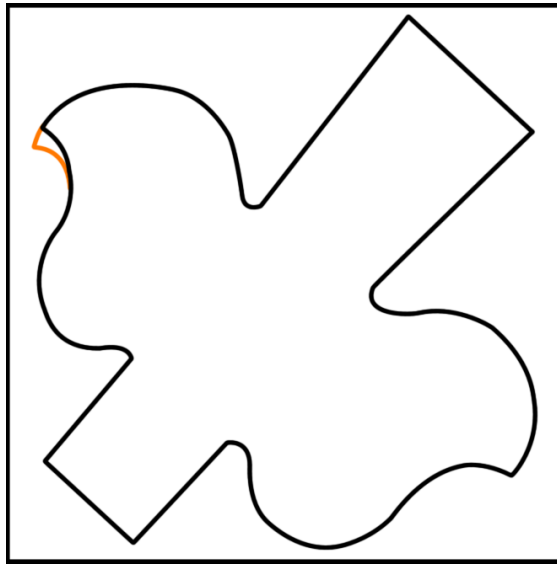
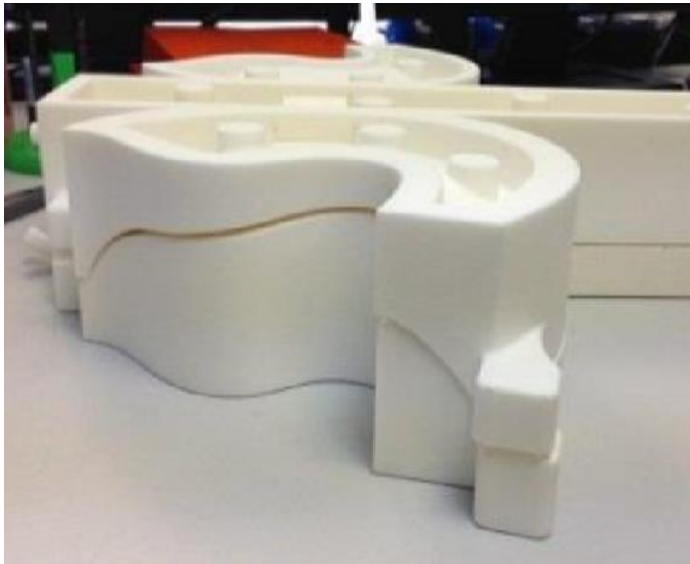
Up to now 10 sets of tools have been printed

Initial two tools were printed in Polyamide, a week to production and delivery time.

All other tools were printed in Alumide costing £1000 - £1500 and taking a week to print.

Traditional tooling would have cost up to £25'000 per set of tools and would have taken 3 – 6 months to arrive.





The main challenges the team identified include:

- If print orientation is not specified the print will not warp in the right direction and the tool will not join correctly.
- Limitations in some materials, heat transfer, warping, strength (after heating).
- Bed size limitations, this limits where the tools get printed and how the parts are oriented.
- Bed size limitations, this limits where the tools get printed and how the parts are oriented.



# Generation 2 Cap

The generation 2 cap shown is the cap developed by Paxman, the University of Huddersfield's design team and silicone manufacturer Primasil Silicones.

The collaboration between Paxman and the university of Huddersfield has allowed Paxman to gain knowledge in design software and or emerging technologies not commonly available to SME's.

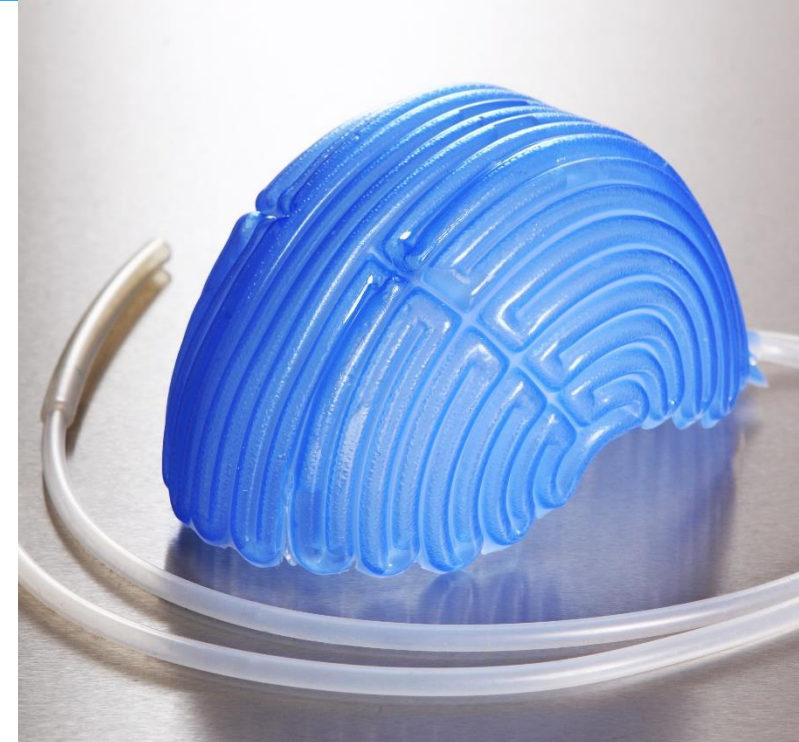
This has allowed Paxman to adapt and make design changes quickly and for a low cost allowing a quicker route to market.



## Current Achievements Include –

A successful KTP graded excellent,  
A second KTP currently underway,  
Two worldwide patents and two UK Patents  
Winner of Medtec Ireland Exhibitor Innovations  
Accolade  
Winner of West Midland Medilink Innovation  
Award  
Winner of Yorkshire and Humber Healthcare  
Partnership with Academia Award  
Insider's 2016 Made in Yorkshire Awards  
Journal Papers  
Conference Papers

And More!



# Product Design, Supporting Research, Academic work, and other activities:

## ART DESIGN ARCHITECTURE HUDDERSFIELD

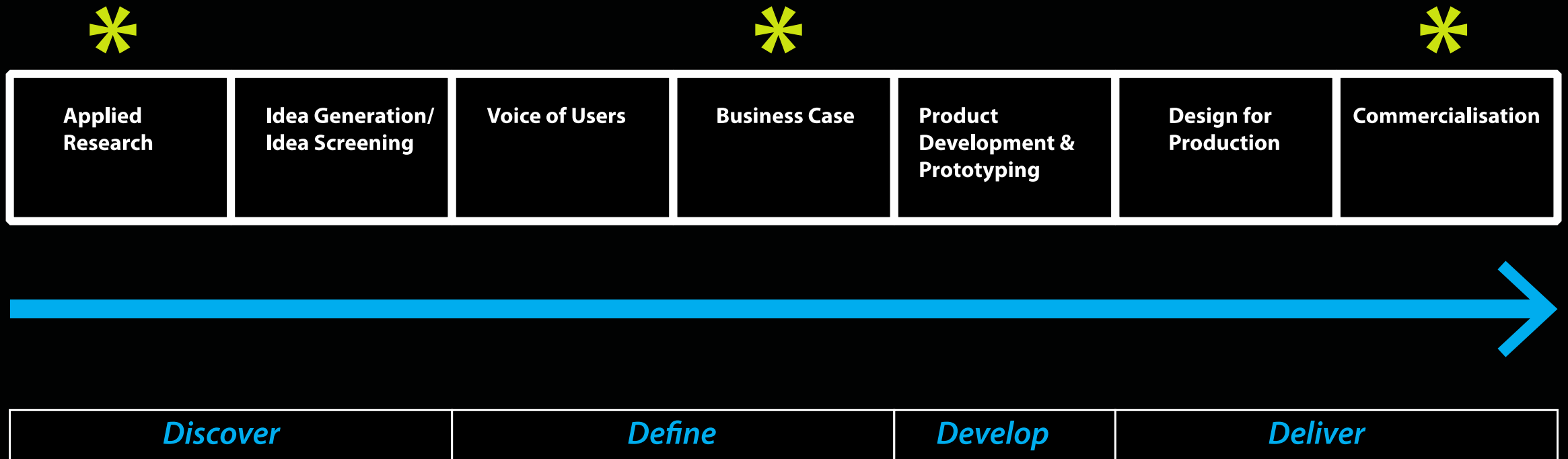


- 115 Academic staff, Including 12 Professors; 4 Readers
- 50 Admin, Technical and Support staff
- Strong partnerships with a wide range of external stakeholders and organisations
- Local, Regional, National, International
- Over 2500 students

# BA/BSc Product Design at Huddersfield:

**CHANGE YOUR MINDSET**

**THINK ABOUT CREATING IP NOT PROJECT MARKS**





# AWARD-WINNING, RESEARCH ACTIVE AND ENTERPRISING COURSE TEAM



## OUR STUDENT SUCCESS'

New Designers Mars Award for Design Thinking **WINNER 2015**

Electrolux Design Lab **WINNER 2015**

Autocar 'Next Generation' Design Prize **FINALIST 2013, 2015**

New Designers Product Design Award **WINNERS 2005, 2011, 2012**

D&AD Awards **FINALIST 2013**

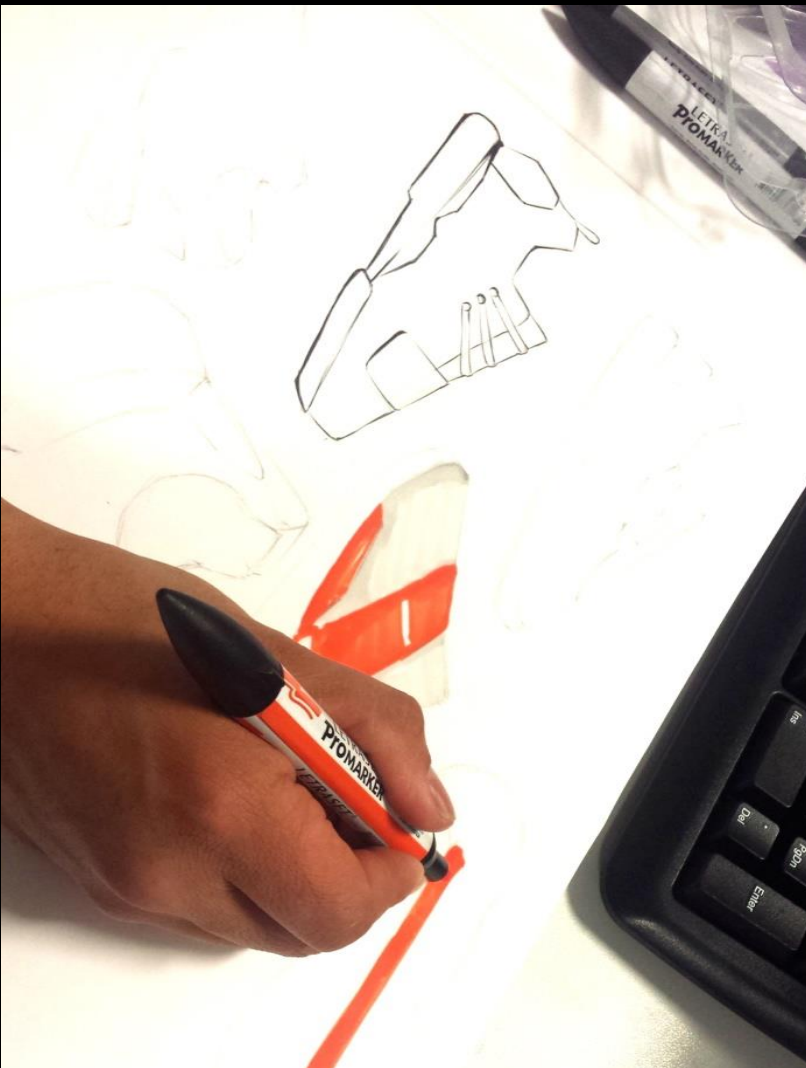
RSA Design Award **FINALISTS**

Design Innovation in Plastics **FINALISTS (2 of 6)**





# DEVELOP YOUR SKETCHING SKILLS







# PITCH YOUR CREATIVE IDEAS TO DIRECTORS & DESIGN PROFESSIONALS



# DEVELOP YOUR VISUALISATION SKILLS





# BECOME AN EXPERT IN 3D CAD & 3D PRINTING





# BECOME ONE OF OUR SUCCESS STORIES



Left to right : **Adam Barnes**, Transport Design BA(Hons), 2008. **Cephas Howard**, Creative Imaging BA(Hons). **Tim Ainley**, Product Design BA(Hons), 2005. **Michael Fuller**, Product Design BSc(Hons), 2009. **Stewart Whitehead**, Product Design with Animation BA(Hons), 2008.



“We only recruit the most talented graduates and benefit from their high level of design




Marcus Hartley graduated from the Product Design with 3D Animation BA(Hons) in 2004. After graduating he attended the New Designers exhibition in London and managed to win the 2004 James Dyson foundation award with his final year project (the hammer). After an extensive interview process he was offered a job with Dyson. In late 2004 Marcus started on the Dyson Airblade project (hand dryer), successfully designing, manufacturing, testing and launching this product in late 2006. He was responsible for both setting up the new production facility in the Far East and delivering this project to market. Once AB01 was out of the way he then moved on to AB03 which was successfully launched in early 2008. To the current day he continues to work on new and exciting products!



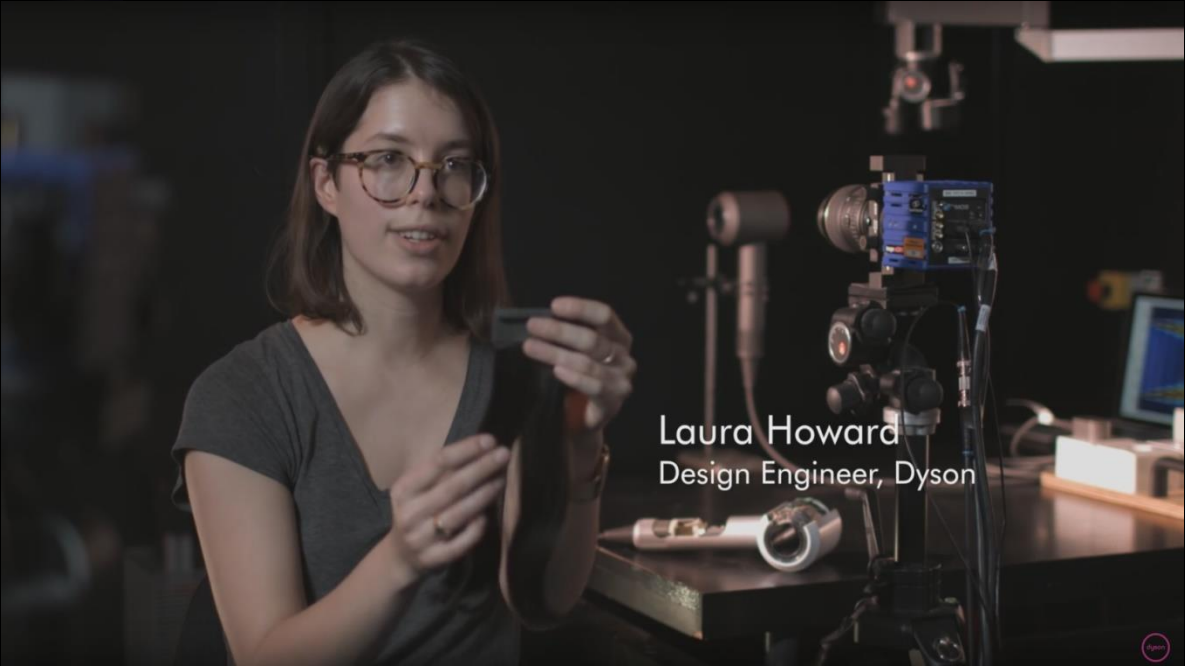
*University of*  
**HUDDERSFIELD**  
Inspiring tomorrow's professionals

**Marcus Hartley**  
**Design Engineer**  
**Dyson**



A man with short brown hair, wearing a black button-down shirt, is seated at a white workbench in a workshop. He is looking off-camera to his right with a thoughtful expression. On the workbench in front of him is a white Dyson cordless stick vacuum cleaner, which is partially disassembled to show its internal components. A metal tool with a green handle is also on the table. The background is filled with various workshop items, including blue storage bins and tools.

Marcus Hartley  
Engineer

A woman with dark hair and glasses, wearing a grey t-shirt, is holding a small, dark, cylindrical object in her hands. She is looking at the object with a focused expression. In the background, there is a complex mechanical assembly mounted on a stand, featuring a blue circuit board and various sensors or cameras. A microphone is also visible on a stand. The setting appears to be a laboratory or a specialized workshop.

Laura Howard  
Design Engineer, Dyson

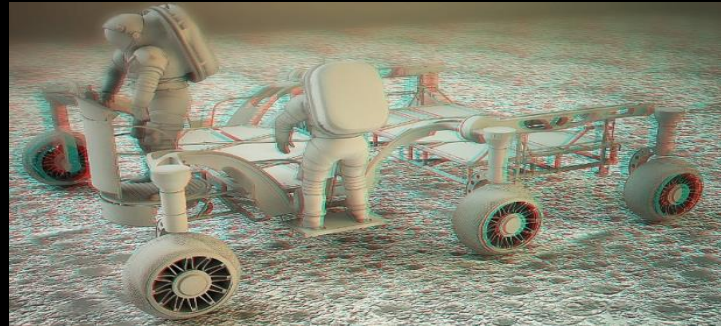


**A MATURE COURSE, COMMERCIAL APPROACH, EMPLOYABILITY PROSPECTS, GOOD INDUSTRY LINKS, NO EXAMS, A VISIBLE, ACCESSIBLE COURSE TEAM AND VERY SATISFIED STUDENTS**



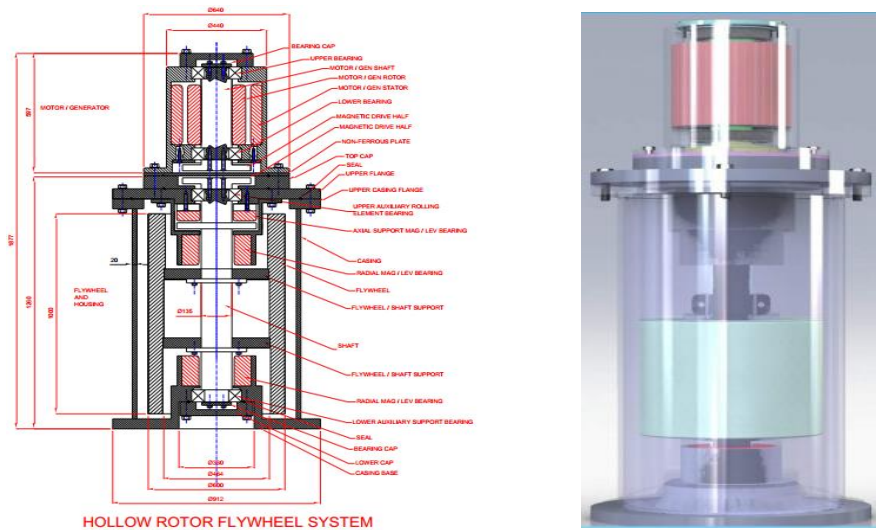


SAMPPLÉ PROJECTS:

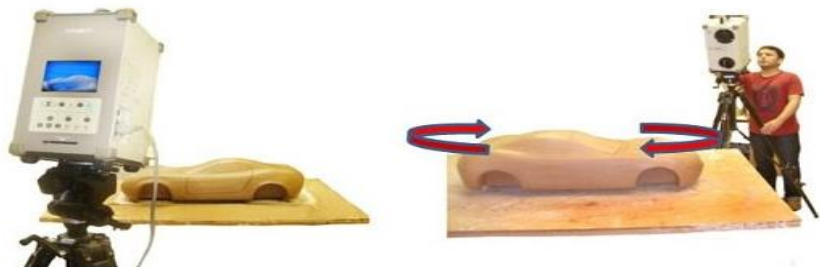




# Enterprise activities



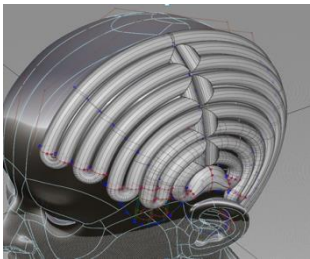
Kinetic Energy Storage Device, ESP Ltd



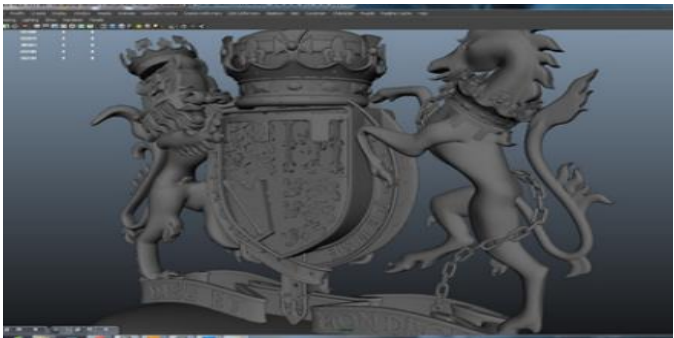
3D Scanning: Mackinnon & Saunders



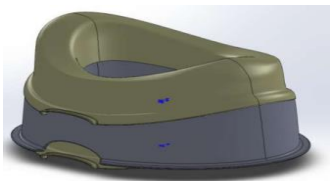
Wheelie Bin Lock: JA innovation



Paxman Cap



Royal Coat of Arms, 3M Buckley



Portable Potty:  
Simple Little Creations Ltd



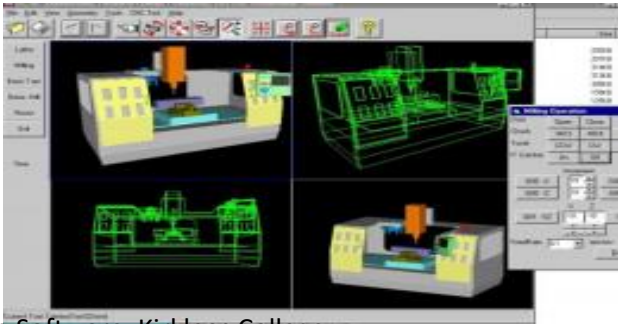
Blister pack opener:



Bob the Builder Tractor : Mackinnon & Saunders



Visits & Training: Uludag University of Turkey, Ural State Academy of Architecture & Arts, Russia

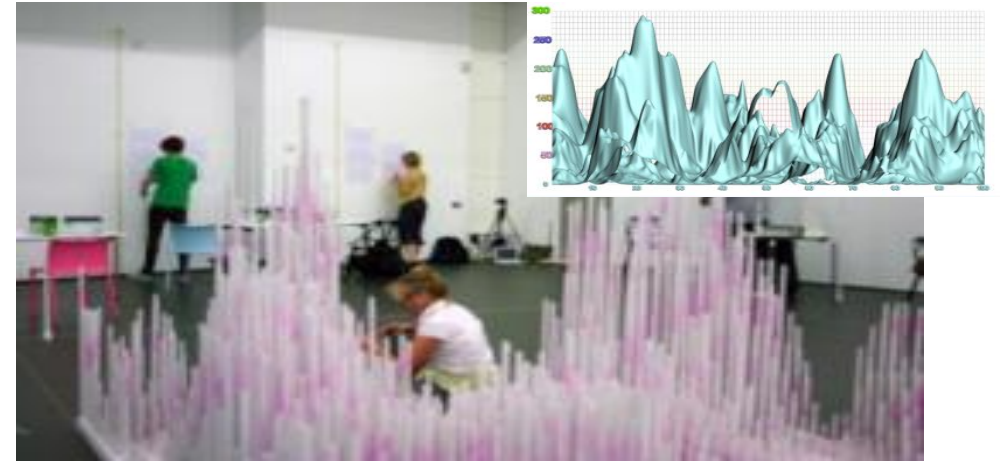


CNC Learning Software: Kirklees College

# Interdisciplinary & International Impact



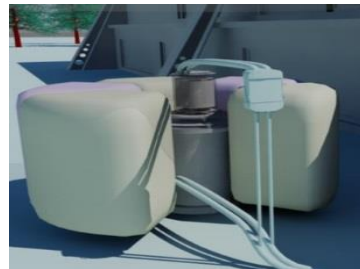
Rupert Till-Heritage, Music



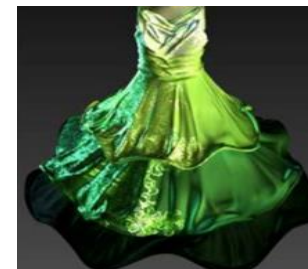
Jill Townsley, Art



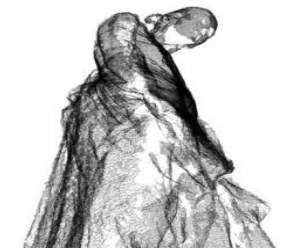
Business L'Oreal



Engineering



Costume



Digital Doubles



International





# Future Factories (2003-2010)



Future Factories focuses on 3D printing,

- Iconic designs ranging from gallery pieces to retail products,
- Work acquired the Museum for Modern Art in New York and DHUB, Design Museum Barcelona



Figure 200  
Digital Rendering of Aorta 2007

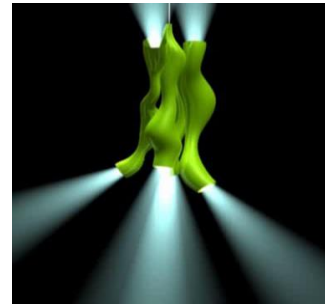


Figure 215  
MMP Polished Stainless Steel Icon



Figure 211  
Conventional Polishing – Steel Shot



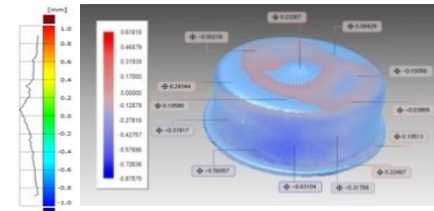
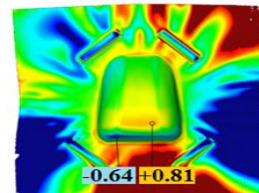
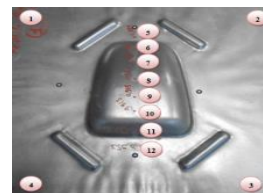
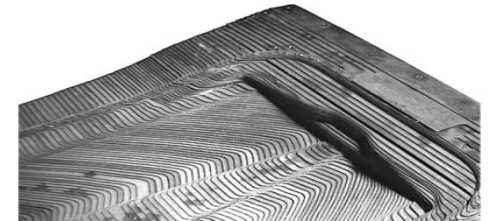
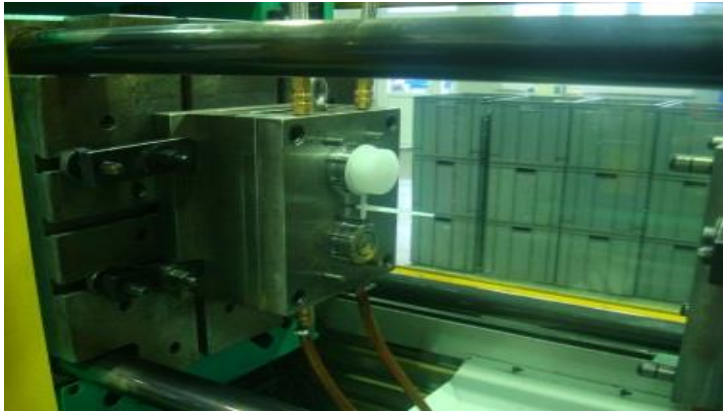


# Automake (2006)



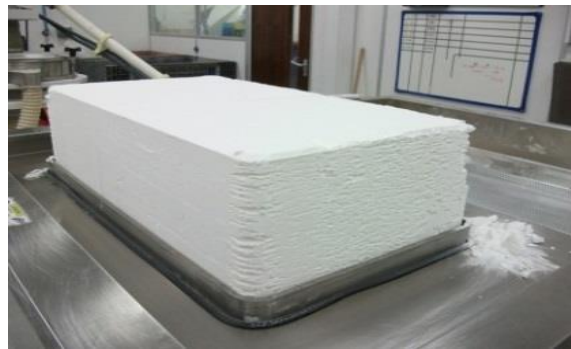
# Low Cost Tooling for Product Design (2012-2015)

Experimental Investigation of Sheet Metal Forming Using a Recyclable Low Melting Point Alloy Tool, Injection Moulding using Low melting alloy inserts, Carbon Fibre using 3D printed mould.





# Prototyping using 3D printing:



## Thermal Properties:

Melting point	DIN 53736	172 - 180	°C
Vicat softening temperature B/50	DIN EN ISO 306	163	°C
Vicat softening temperature A/50	DIN EN ISO 306	181	°C



The tool was produced using a **EOS 3D laser sintering machine** and **PA2200 material**. (Fine Polyamide PA 2200 for EOSINT P). Normally the tool would CNC manufactured in Aluminium at a much higher cost. We also used Alumide



## 3D Printing/ Rapid Prototyping Resources:

We operate three rapid prototyping machines which can quickly and accurately produce parts from CAD files. The file format required is STL and **Solidworks** software produces the best results although **3D Max** files saved as STL format can work with some fixing. VRML files from **Archicad** can also be printed. Students are charged for parts produced at cost price.

### ADA 3D Print Lab - QSB03:

- **3D Systems Projet 5500x** [3D Systems.com](http://3D Systems.com)

3D Systems Projet 5500x uses MultiJet Printing (MJP) technology to build very high quality, accurate and tough multi-material parts. Maximum build size = 533(x) x 381(y) x 300(z)

- **Projet CJP 650** [www.3DS.com](http://www.3DS.com)

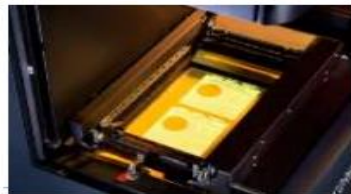
The Projet 650 is a powder based machine which prints a binding fluid on to each successive 100 micron layer of powder laid down to build up a 3D representation of the part which has been designed. Maximum build size = 250(x) x 380(y) x 200(z)mm

- **Stratasys FDM360mc** [FDM print process](http://FDM print process)

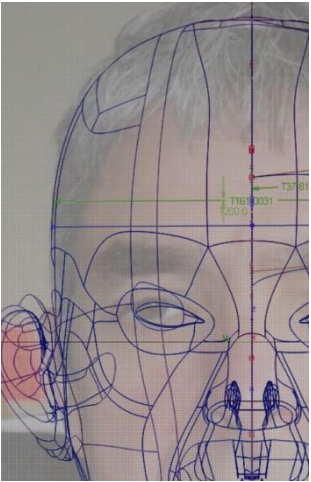
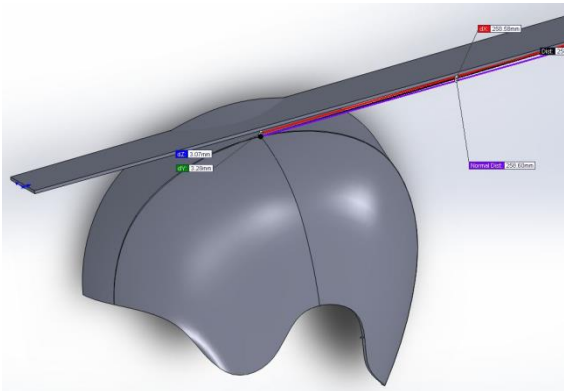
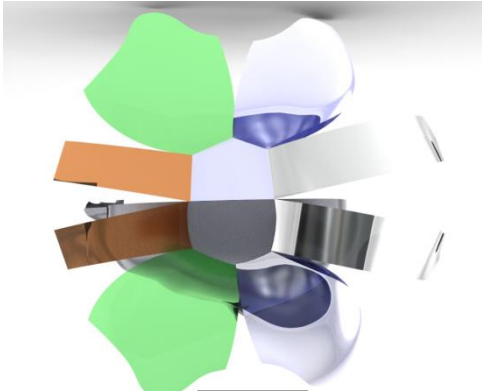
This machine uses Fused Deposition Modelling technology to produce parts which are very strong and useable as functional prototypes generally ABS. Maximum build size = 360(x) x 250(y) x 400(z)mm

### 3M Business Innovation Centre :

EOS FORMIGA P 110 Laser Sintering Machine cost around £200k, Similar Machines for metal sintering cost over £500k



# Paxman Project: Visual Summary



**Any Questions?**